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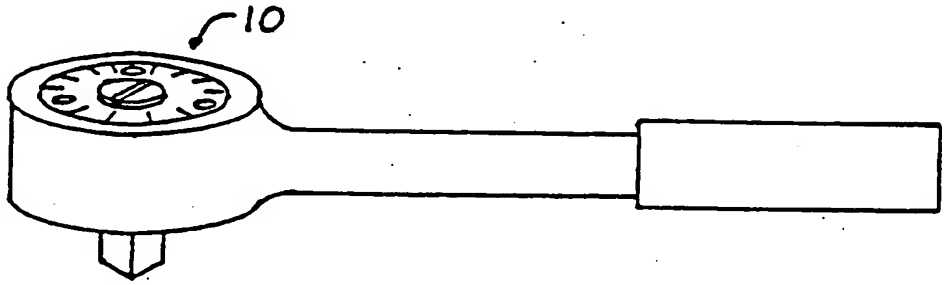
(54) **DISPOSITIF D'ENTRAINEMENT A CAME**
(54) **CAM DRIVE MECHANISM**



(57) Mécanisme réversible à entraînement sans engrenage destiné à une clé à douilles comprenant un élément entraîné muni d'une bride support de centrage supérieure et d'une cage support de centrage inférieure, entre lesquelles se trouve une surface en forme de came autour de la circonférence définissant trois rampes bidirectionnelles symétriquement opposées. L'élément entraîné est centré axialement dans un élément d'entraînement délimitant un alésage cylindrique rond, entre lequel chaque rampe bidirectionnelle forme un coin droit et un coin gauche. Entre chaque rampe bidirectionnelle se trouvent deux rouleaux cylindriques maintenus éloignés dans leurs coins gauche et droit respectifs par un ressort à lame. La circonférence à cames de l'élément entraîné n'entre pas en contact avec la circonférence intérieure de l'alésage dans lequel le mécanisme est centré. Les rouleaux de plus grand diamètre et la pression des ressorts à lame offrent une résistance de frottement adéquate pour immobiliser l'élément entraîné tandis qu'un sélecteur rotatif au pouce permet de surpasser une détente à ressort et à tige pour décoincer soit les trois rouleaux gauches ou les trois rouleaux droits pour changer le sens de l'entraînement. Cela permet de modifier d'une seule main le sens de l'entraînement. Les rouleaux de plus grand diamètre permettent également d'obtenir un meilleur blocage de l'entraînement et ils résistent mieux aux particules et aux imperfections provoquées par l'usure et par la contamination.

(57) A reversible gearless drive mechanism for a socket wrench comprises a driven member having an upper centering support flange and a lower centering support race, between which is a cam-like area around the circumference defining three symmetrically opposite bi-directional ramps. The driven member is axially centered within a drive member defining a round cylindrical bore, between which each bi- directional ramp forms one right hand wedge and one left hand wedge. Between each two bi-directional ramps are two cylindrical rollers held apart into their respective left hand and right hand wedges by a leaf spring. The cammed circumference of the driven member does not contact the inner circumference of the bore for centering support permitting the use of larger diameter rollers relative to the diameter of the bore in which the mechanism is centered. The larger diameter rollers combined with the pressure of the leaf springs provide adequate friction drag to hold the driven member stationary while a thumb operated rotary selector switch overcomes a spring and pin detente to unwedge either the three left hand or the three right hand rollers to change the direction of drive. This permits a change in drive directions with only one available hand. The larger diameter rollers also provide a more positive lock for the drive and are more tolerant to small particles and imperfections caused from wear or contamination.

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CAM DRIVE MECHANISM

The present invention relates to a reversible gearless drive mechanism that would ordinarily be in the head of a socket wrench.

This type of mechanism is desirable because it can provide no noticeable free-play between the drive stroke and return stroke of the wrench.

It is common for mechanisms of this type to comprise a driven member with ramps around the circumference, centered within a drive member defining a round cylindrical bore, between which a number of rollers are located such that they may wedge between the ramps and the bore to lock the two members together wherein the ramped surface of the driven member protrudes out to contact the inner circumference of the bore in at least three places for axial centering. This extra material reduces the available space for the drive rollers thus limiting the diameter of roller that can be used. I have found that the smaller the diameter of the roller used in such a mechanism, the more susceptible it is to slip or skid over small particles or imperfections such as from wear or contamination. The smaller the diameter of the roller the more precise control and positioning are required to achieve the desired wedging action.

A common means of reversing the direction of drive in this type of mechanism is by means of a driven member in which a square out-put for attaching to a socket can be pushed through the center to extend out either the top or the bottom to provide reverse by removing the socket and turning the wrench over and re-attaching the socket. Another means of reversing the drive is by a rocker switch that requires both vertical and rotary motion to cause it to re-position the rollers to reverse the drive. Both of these types of reversing may be inconvenient in the event of unthreading a bolt and as the bolt is backing out, the socket wrench is backed up against an obstruction. The wrench may not be pulled off the socket and a vertically operated switch may not be possible to operate to reverse the drive to thread the bolt in and remove the wrench.

It is also common for mechanisms of this type to use a

rotary reverser switch that may require the use of two hands to reverse the drive. One hand may be required to hold the socket attached to the driven member while the other hand rotates a selector switch to overcome a detente preventing the internal mechanism from just rotating around within the bore as there is no integral means of holding the driven member stationary while re-positioning the rollers.

It is desirable to have a mechanism of this type that can be reversed with one hand, by some rotary or horizontal means that may avoid obstruction, comprising the largest diameter rollers possible relative to the diameter of the bore in the drive member, providing a more positive reliable lock for the drive. The present invention relates to a reversible gearless drive mechanism for a socket wrench that may be reversed with one hand by a rotary means and may comprise larger diameter cylindrical rollers than other designs.

The present invention consists of a reversible gearless drive mechanism for a socket wrench. The mechanism comprises a driven member having an upper centering support flange defining a detent hole and a lower centering support race, between which is a cammed area around the circumference defining three symmetrically opposite bi-directional ramps, below which is a means for attaching a socket. It is preferred that the cammed circumference be made up of three lobes forming three symmetrically curved sides, each lobe being a high point around the circumference forming a bi-directional ramp. The driven member is axially centered within a drive member defining a round cylindrical bore between which each bi-directional ramp forms one right hand wedge and one left hand wedge. The cammed circumference of the driven member does not contact the inner circumference of the bore allowing it to be of a reduced diameter providing more area between the ramps and the bore for the use of larger diameter rollers. Six cylindrical shaped rollers located around the cammed circumference of the driven member, one roller on either side of each of the three bi-directional ramps within the circumference of the bore for a total of three left hand and three right hand drive rollers. Three leaf springs located around the cammed circumference of the driven member within the circumference of the bore such that they link the six rollers into three pairs, holding each pair apart into their

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respective left hand and right hand wedges formed between the bi-directional ramps and the inner circumference of the bore. A flat circular selector switch having three legs, the legs located equidistant around and within the circumference on the lower side and an area between one leg and a central axis defines two detente notches.The selector is axially mounted on top of the driven member so that the legs protrude down through three fluted areas within the outer circumference of the upper support flange. Each leg is located between each two roller pairs defined by the leaf springs. When the selector switch is rotated in the desired drive direction, the three legs unseat either the three left hand or three right hand drive rollers from their wedges which apply pressure on the three leaf springs which in turn apply pressure directly on the remaining three rollers holding them into their respective wedges such that they will instantly wedge and lock the drive in one direction of rotation and unlock and slide along the inner circumference of the bore in the opposite direction of rotation. A detente spring and pin located in the detente hole, such that the pin will align with either of the two detente notches on the selector switch, provides a means for holding the selector switch in either one of two positions unseating either the three left hand drive rollers or the three right hand drive rollers. The driven member may be held stationary by means of friction between the larger diameter rollers and the bore, due to the leaf spring pressure, while the selector switch is rotated overcoming the detente to change the direction of drive. The turning radius of the selector between detente positions is approximately 1/18 of a turn. The larger diameter rollers are less likely to slip or skid over small particles or imperfections such as from wear or contamination. The larger diameter rollers paired in the leaf spring configuration may hold the driven member stationary while the selector is rotated overcoming the detente requiring the use of only one hand to reverse the direction of drive. The rotary switch is unlikely to become inoperative due to an obstruction.

The invention, as exemplified by a preferred embodiment, is described with reference to the drawings in which:

Figure 1 is an exploded view of an embodiment of a cam-drive mechanism for a socket wrench of the invention;

and

Figure 2 is a bottom view of element 40 of Figure 1; and

Figure 3 is a bottom view of element 12 of Figure 1; and

Figure 4 is a top perspective view of elements 68,70, and 72 of Figure 1; and

Figure 5 is a perspective view of a preferred embodiment of a cam-drive mechanism.

Referring to the drawings, the embodiment of the invention shown, a cam drive mechanism for a socket wrench 10 comprises a driven member 12. The driven member has an upper support flange 14 defining three fluted areas 15,16, and 17 around the circumference and a lower support race 18 between which is a cammed area around the circumference 19 as may be seen in Figure 1. The cammed area defines three lobes 20,22, and 24 forming three symmetrically opposite curved sides 26,28, and 30 as may be seen in Figure 3. Below the lower support race is an area defining a groove 32 around the circumference below which is a standard means for attaching to a socket. Located downward from the top side of the driven member at a point away from center directly over one of the lobes is an area defining a detente hole 34. Centrally located on top of the driven member is a dowel 36 having a central area defining a threaded hole 38 down into the center of the driven member. A round flat selector switch 40 having three legs 42,44, and 46 around within its circumference on the lower side and an area defining two detente grooves 48 and 50 as can be seen in Figure 2 , is located such that the three legs pass through the three fluted areas in the upper support flange, leg 46 passing through fluted area 15, so that one of the two detente notches align with a detente pin 52 held upwardly by a spring 54, both located in the detente hole. The selector has an area defining a central axis 56 in the center such that the axis fits over the dowel allowing a machine screw 58 to retain the selector. The driven member combined with the axially mounted selector are centrally located within a drive member 60 defining a round cylindrical bore 62 and a top and bottom counter- bore 64 and 66. The upper support flange rests in the

upper counter bore providing axial centering support for the driven member plus radial support when a socket is pulled off of the member. Six cylindrical shaped rollers are located around the circumference of the driven member , two rollers between each two lobes on the cammed circumference such that each pair will be held apart into either a left hand or a right hand wedge between the lobes and the bore by one of three leaf springs 68 for a total of three right hand drive rollers 70 and three left hand drive rollers 72. A round, flat, lower centering support disk 74, having an area defining a central axis 76, is located so the central axis fits over the lower support race of the driven member and the outer circumference fits into the lower counter-bore of the drive member. A snap ring 78 is then inserted into the groove below the lower support race thus retaining the entire mechanism within the bore due to the upper support flange and lower support disk being retained one to another through the driven member into their respective counter-bores. The cammed area does not need to contact the inner circumference of the bore for axial centering support. This enables the cammed circumference of the driven member to be of a minimum diameter enabling the use of the largest possible cylindrical rollers for a given diameter of bore in the drive member. To change direction of drive the selector switch is rotated in the desired direction, the legs unseating the three previously wedged rollers and pushing them against the leaf springs which in turn force the previously un-wedged rollers into their respective wedges between the cammed surface and the bore. The wedged rollers try to roll and instantly wedge between the cam and the bore in the drive direction of rotation and un-wedge and slide along the inner circumference of the bore in the opposite direction of rotation. While reversing the drive, the selector must overcome the force of the detente holding it in the present position. The presently wedged rollers hold the driven member stationary while the detente is overcome. Then the leaf springs holding the previously un-wedged rollers into their wedges hold the driven member stationary, while the selector locates the selected detente. Large enough diameter rollers can be used to provide enough friction drag to hold the driven member stationary. This permits a change in drive directions with one available hand and using a thumb to operate the rotary selector by some means of gripping the circumference.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A reversible gearless drive mechanism for a socket wrench, comprising:

a driven member having an upper centering support flange defining a detente hole and a lower centering support race, and a cammed area around the circumference between the flange and the race defining three symmetrically opposite bi-directional ramps, with a means for attaching a socket below the race; and

a drive member defining a round cylindrical bore having a counter bore top and bottom, axially centering the driven member within the bore and the bi-directional ramps on the driven member each forming one right hand and one left hand wedge between the drive member and the driven member; and

six cylindrical shaped rollers located around the cammed circumference of the driven member, one roller on either side of each of the three bi-directional ramps within the circumference of the bore for a total of three left hand and three right hand drive rollers; and

three leaf springs located around the cammed circumference of the driven member within the circumference of the bore such that they link the six rollers into three pairs, holding each pair apart into their respective left hand and right hand wedges formed between the bi-directional ramps and the inner circumference of the bore; and

a flat circular selector switch having three legs, the legs located equidistant around and within the circumference on the lower side and an area between one leg and a central axis defining two detente notches, located such that the legs protrude down through the upper support flange between each two roller pairs defined by the leaf springs such that when the selector switch is rotated in the desired drive direction, the three legs unseat either the three left hand or the three right hand drive rollers from

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their wedges applying pressure on the three leaf springs that in turn apply pressure directly on the remaining three rollers holding them into their respective wedges such that they will instantly wedge and lock the drive in one direction of rotation and unlock and slide along the inner circumference of the bore in the opposite direction of rotation; and

a detente spring and pin located in the detente hole such that it will align with either of the two detente notches on the selector switch providing a means for holding the selector switch in either one of two positions, unseating either the three left hand drive rollers or the three right hand drive rollers; and

a flat circular lower-centering support disk located within the lower counter bore of the drive member defining a round central bore providing axial centering support around the lower support race of the driven member.

2. A mechanism as claimed in claim 1, wherein the driven member has three lobes around the cammed circumference forming three symmetrical curved sides, each lobe defining one bi-directional ramp.

3. A mechanism as claimed in claim 1 , wherein the bi-directional ramps do not contact the inner circumference of the bore.

4. A mechanism as claimed in claim 3, wherein the driven member will be held stationary by means of friction between the rollers and the bore due to the leaf spring pressure, while the selector switch is rotated overcoming detente pressure to change the direction of drive.

5. A mechanism as claimed in claim 4, wherein the turning radius of the selector switch between right hand drive and left hand drive is approximately 1/18 of a turn.

6. A mechanism as in claim 1, wherein the upper support flange defines three fluted areas from its circumference providing a means for the legs on the selector switch to pass through the upper support flange.

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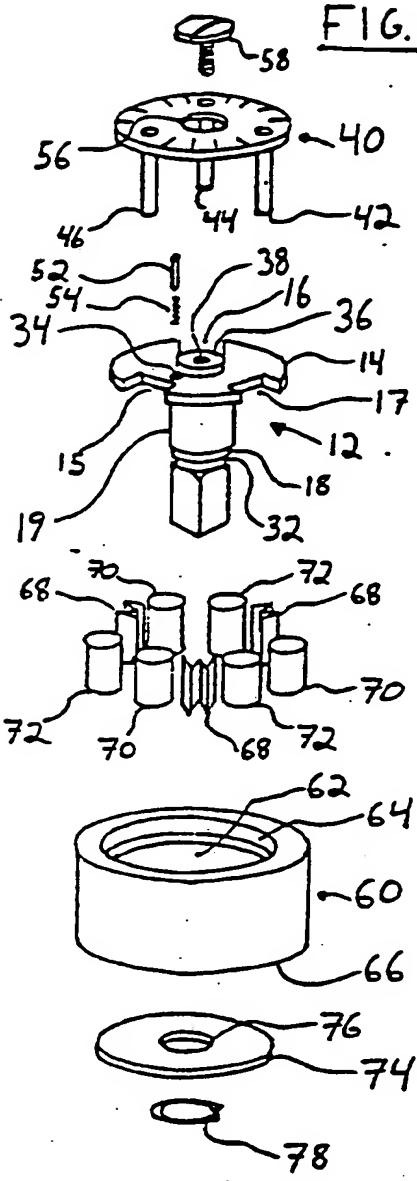
FIG. 1



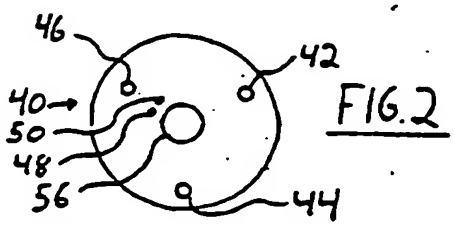


FIG. 2

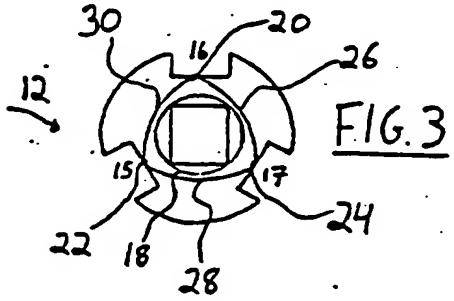
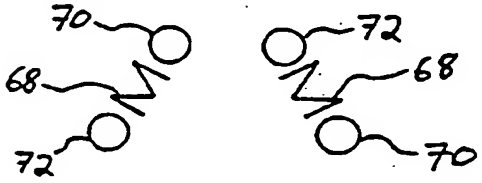


FIG. 3



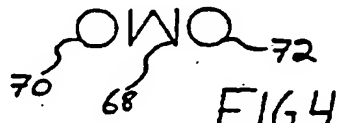


FIG. 4

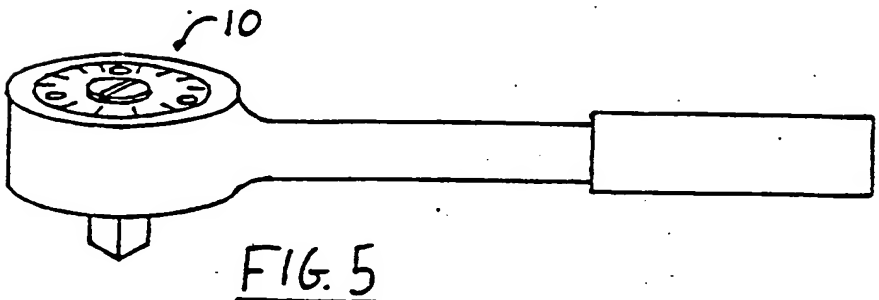


FIG. 5